

SYMPOSIUM

Antioxidant effect of various rosemary (*Rosmarinus officinalis* L.) clones⁺Éva Stefanovits-Bányai^{1*}, Mária H. Tulok², Attila Hegedűs¹, Csilla Renner², Ilona Szöllősi Varga³¹Department of Applied Chemistry, Szent István University, Budapest, Hungary, ²Department of Medicinal and Aromatic Plants, Szent István University, Budapest, Hungary, ³Department of Genetics and Molecular Biology, University of Szeged, Szeged, Hungary

ABSTRACT The antioxidant effects, the levels of total phenol and the total phenol contents of volatile oils and plant extracts were determined in eight various Rosemary (*Rosmarinus officinalis* L.) clones. Antioxidant activities and the total phenol contents were measured by spectrophotometric method as well as the volatile oil content of the fresh plants with gas chromatograph. Our preliminary results clearly indicate that the antioxidant capacity of volatile oils and plant extracts closely related to the total phenol contents. Reason of the observed differences should be revealed by the determination of the quantity and quality of the individual volatile oil components.

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KEY WORDS*Rosmarinus officinalis* L.
rosemary oil
total phenol content
FRAP

Rosemary (*Rosmarinus officinalis* L.) is a very important medicinal and aromatic plant, which belongs to the Lamiaceae family and has been cultivated for a long time. Anthropologists and archaeologists have found evidence that rosemary herbs were used as medicinal, culinary and cosmetic virtues in the ancient Egypt, Mesopotamia, China and India.

Rosemary is a widely used aromatic and medicinal plant nowadays. *Rosmarini folium* has antibacterial, antioxidant and antiphlogistic effect. The essential oil enhances the blood-circulation of the limbs, has antirheumatic effect and relieves the neuralgic pains. Besides the therapeutical application, the essential oil is widely applied in the cosmetic industry producing various Cologne waters, bathing essences, hair lotions and shampoos. The leaf of rosemary is an indispensable spice of the French, Italian and Spanish cuisine.

Rosemary is a perspective plant culture in the world, it is in the middle of interest of plant breeders (Chalchat et al. 1993; Domokos et al. 1997; Mulas et al. 1998). Because of its sensitivity to cold rosemary was not cultivated in Hungary, until a frost-tolerant cultivar of rosemary the "Harmat" (Domokos et al. 1997) was not isolated.

Rosemary is cultivated for the valuable oil which can be extracted from the harvested plants when flowers are in buds.

It is well known that the activity of rosemary extracts in food industry and medicine due to the presence of some important antioxidant oil and phenolic components (Cuvelier et al. 1996; Fadel and El-Massry 2000), to prevent oxidative

degradation of oil and lipid containing foods (Economou et al. 1991; Baniyas et al. 1992; Chen et al. 1992; Clifford and Cuppet 1993; Pokorny 1997). Its antioxidant properties not only exploited by the food industry but by the plant protection techniques and therapy (Mongold et al. 1991; Paris et al. 1993), as well.

Our aim was to compare oil contents as well as the level of total phenol and antioxidant effects in the volatile oil and in the plant extracts of different originated rosemary clones.

Materials and Methods

Plant material (*Rosmarinus officinalis* L.) of the experiment were originated from rosemary clones of the germplasm collection of the Department's Research Station, Soroksár. Fresh plant materials (160 mg/10 ml) were extracted with methanol : water 4:1 for 2 hours (Table 1).

The essential oil content of the leaf drug was determined by hydrodistillation applying improved Clevenger-type apparatus, according to the Hungarian Pharmacopoeia VII at the laboratory of the Department of Medicinal and Aromatic Plants.

Table 1. Origins and marks of the samples.

Marks	Origin	Sample
A	Hungary	Harmat
B	Italy	Blauer Toscaner
C	Croatia	Horváth
D	Morocco	Salem
E	Germany	Veitschöchheim
F	Spain	Majorca
G	Greece	Gorizia
H	England	Hardy

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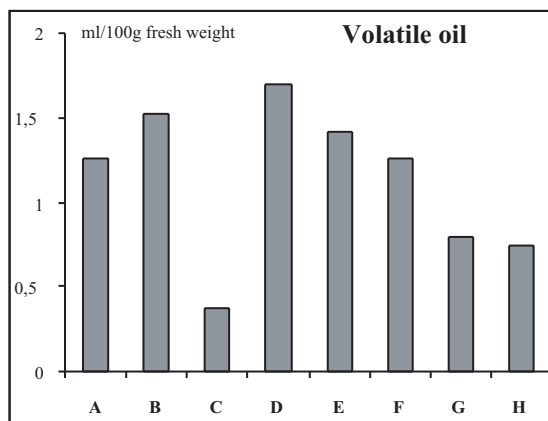


Figure 1. Volatile oil contents (ml/100 g fresh weight) of various rosemary (*Rosmarinus officinalis* L.) clones.

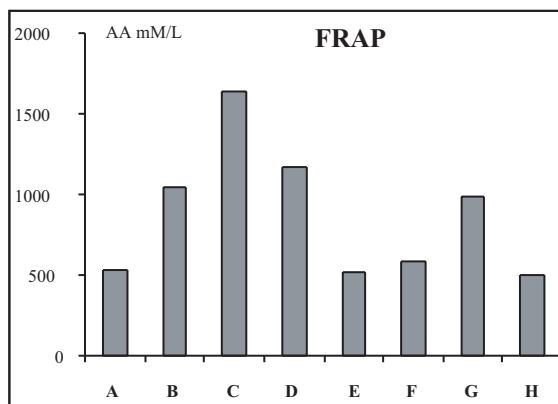
Total soluble phenols were determined using Folin-Ciocalteu reagent according to the method of Singleton and Rossi (1965). The content of soluble phenols was calculated from a standard curve obtained with different concentrations of gallic acid.

Antioxidant power was measured by the FRAP (Ferric Reducing Ability of Plasma) method at $\lambda=593$ nm (Benzie and Strain 1996).

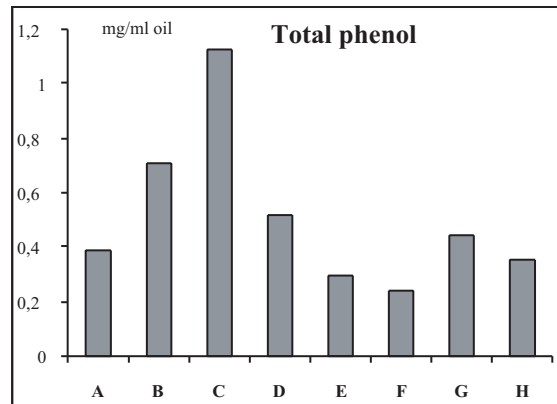
Results and Discussion

Our results are summarized in Figures 1-3. We have found differences in the volatile oil contents of the samples ranging from 0.368 to 1.691 ml oil/ 100g fresh weight (Fig. 1).

Marked differences occurred in the FRAP values of volatile oils (Fig. 2/A). Threefold differences were detected between the lowest and the highest level of the ascorbic acid

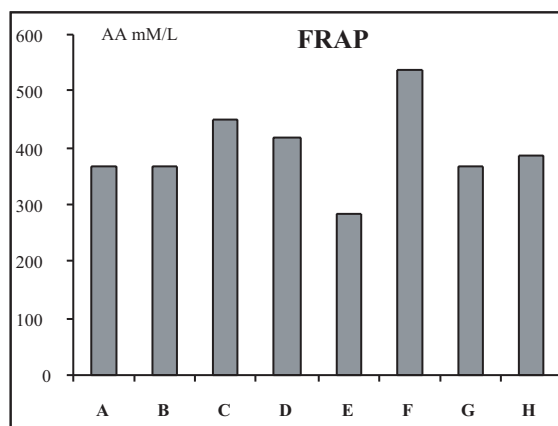


A

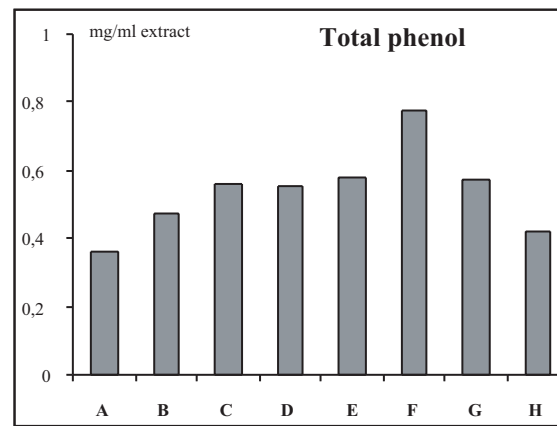


B

Figure 2. Antioxidant capacity (A) and total phenol content (B) in oils of various rosemary (*Rosmarinus officinalis* L.) clones.



A



B

Figure 3. Antioxidant capacity (A) and total phenol content (B) in plant extracts of various rosemary (*Rosmarinus officinalis* L.) clones.

(AA) equivalent antioxidant activities. The “Horvát” (C) clone showed the highest FRAP-values (1643 AA mM/L).

We have found similar tendency in the case of total phenol contents, the “Horvát” (C) clone showed the highest level (1.12 mg/ml oil).

In contrast to the above mentioned results, plant extract of “Majorca” (F) possessed the highest antioxidant capacity and total phenol content (Fig. 3).

Our preliminary results clearly indicate that the antioxidant capacity of volatile oils and plant extracts closely related to the total phenol contents. Reason of the observed differences should be revealed by the determination of the quantity and quality of the individual volatile oil components.

References

- Banias C, Oreopoulou V, Thomopoulos CD (1992) The effect of primary antioxidants and synergists on the activity of plant extract in lard. *J Am Oil Chem Soc* 69:520-524.
- Benzie IIF, Strain JJ (1996) The ferric reducing ability of plasma (FRAP) as a measuring of “antioxidant power”: The FRAP assay. *Anal Biochem* 239:70-76.
- Chalchat JC, Garry RP, Michet A, Benjilali B, Chabart JL (1993) Essential oil of rosemary (*Rosmarinus officinalis* L.). The chemical composition of oil various origins (Morocco, Spain, France). *J Essent Oil Res* 5. 6. 613-618.
- Chen QY, Shi H, Ho CT (1992) Effects of rosemary extracts and major constituents on lipid oxidation and soybean lipoxygenase activity. *J Am Oil Chem Soc* 69:999-1002.
- Clifford HIII, Cuppet S (1993) Effect of bleached and unbleached rosemary oleoresins on light-sensitized oxidation of soybean oil. *J Am Oil Chem Soc* 70:477-482.
- Cuvelier ME, Richard H, Berset C (1996) Antioxidative activity and phenolic composition of pilot-plant and commercial extracts of sage and rosemary. *J Am Oil Chem Soc* 73:645-65.
- Domokos J, Héthelyi É, Pálkás J, Szirmai S, Tulok HM (1997) Essential oil of rosemary (*Rosmarinus officinalis* L.) of Hungarian origin. *J Essent Oil Res* 9:41-45.
- Economou KD, Oreopoulou V, Thomopoulos CD (1991) Antioxidant activity of some plant extracts of the family labiatae. *J Am Oil Chem Soc* 68:109-113.
- Fadel HHM, El-Massry KF (2000) *Rosmarinus officinalis* L.: effect of drying on the volatile oil of fresh leaves and antioxidant activity of their extracts. *J Essential Oil Bearing Plants* 3:5-19.
- Mongold JJ, Camillieri S, Susplugas P, Taillade C, Masse JP, Serrano JJ (1991) The cholagogue/choleretic properties of a lyophilised extract of *Rosmarinus officinalis* L. *Plant Med Phytot* 25:6-11.
- Mulas M, Brigaglia N, Cani MR (1998) Clone selection from spontaneous germplasm to *Rosmarinus officinalis* L. crop. *Proc Plant Biology as a Tool for the Exploitation of Mountain lands*. In S Scannerini et al. eds., *Acta Hort*, 457:278-294.
- Paris A, Strukelj B, Renko M, Turk V, Pukl M, Umek A, Korant BD (1993) Inhibitory effect of carnosolic acid on HIV-1 protease in cell-free assays. *J Nat Prod* 56:1426-1430.
- Pokorny J, Nguyen HTT, Korczak J (1997) Antioxidant activities of rosemary and sage extracts in sunflower oil. *Nahrung* 41:176-177.
- Singleton VL, Rossi JA (1965) Colorimetry of total phenolics with phosphomolybdic phosphotungstic acid “reagents”. *Am J Enol Vitic* 16:144-158.